## LISTING OF THE CLAIMS

Claims 2, 4-11, 14-20, 22-24, 26-32, 36, and 39-40 are pending. No claims are canceled. No claims are added. Please amend claims 4, 11, and 28. The following listing of claims replaces all prior versions, and listings of claims in the application.

**Listing of Claims:**

1. (Canceled).

2. (Previously presented) A method as recited in claim ~~5~~1, wherein the operation of estimating head motion further comprises:

calculating an estimation objective function comprising a set of terms to estimate: (a) each of the set of physical face parameters, (b) a first head pose transform corresponding to the first image, and (c) a second head pose transform corresponding to the second image.

3. (Canceled).

4. (Currently amended) A method as recited in claim ~~5~~3:

wherein the particular face parameter corresponds to the nose tip; and

wherein the predetermined minimum value is zero (0) and the predetermined maximum value is a ~~reasonable~~ value based on absolute values of other of the locations.

5. (Previously presented) A method to estimate head motion between two images of a face, the method comprising operations of:

identifying locations of a plurality of distinct facial features in the two images, the locations corresponding to a number of unknowns determined upon estimation of head motion, the number of unknowns being determined by a number of equations;

converting the identified locations into a set of physical face parameters based on the symmetry of the distinct facial features, the set of physical face parameters reducing the number of unknowns as compared to the number of equations used to determine the unknowns;

adding an inequality constraint on a particular face parameter of the physical face parameters, such that the particular face parameter is constrained within a predetermined minimum and maximum value;

converting the inequality constraint to an equality constraint using a penalty function; and

estimating head motion from identified points in the two images, the identified points being based on the set of physical face parameters.

6. (Previously presented) A method to estimate head motion between two images of a face, the method comprising operations of:

identifying locations of a plurality of distinct facial features in the two images, the locations corresponding to a number of unknowns determined upon estimation of head motion, the number of unknowns being determined by a number of equations;

converting the identified locations into a set of physical face parameters based on the symmetry of the distinct facial features, the set of physical face parameters reducing the number of unknowns as compared to the number of equations used to determine the unknowns; and

estimating head motion from identified points in the two images, the identified points being based on the set of physical face parameters; and

wherein the operation of estimating head motion comprise operations of:

calculating an estimation objective function to determine an initial estimate of head rotation, the estimation objective function comprising a set of terms to estimate: (a) each of the set of physical face parameters, (b) a first head pose transform corresponding to the first image, and (c) a second head pose transform corresponding to the second image;

placing an inequality constraint on a particular face parameter of the set of physical face parameters, such that the particular face parameter is constrained within a predetermined minimum and maximum value;

converting the inequality constraint to an equality constraint using a penalty function; and

adding the equality constraint to the initial estimate [estimation system].

7. (Previously presented) A method as recited in claim ~~5~~1, wherein the identified locations correspond to the eye corners, mouth corners and nose tip.

8. (Original) A method as recited in claim 2, wherein in the operation of estimating the head motion further comprises an operation of multiplying each term of the estimation objective function by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function.

9. (Original) A method as recited in claim 5, wherein in the operation of providing further comprises operations of:

multiplying each term of the estimation objective function and the equality constraint by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function.

10. (Previously presented) A method as recited in claim ~~5~~1, wherein the identifying comprises accepting input from a human user.

11. (Currently amended) A computer-readable medium storing computer-executable instructions that, when executed on a computer, are configured to perform operations of the method of claim ~~5~~1.

12. (Canceled).

13. (Canceled).

14. (Previously presented) One or more computer-readable media containing computer-program instructions executable by a processor to estimate motion between two images, the computer-program instructions comprising instructions for:

determining locations of a plurality of distinct features in the two images;

converting the identified locations into a set of parameters based on the symmetry of the distinct features; and

estimating motion between the two images based on the set of physical face parameters by:

(1) calculating an estimation objective function comprising a set of terms to estimate: (a) each of the parameters, (b) a first transform corresponding to the first image, and (c) a second transform corresponding to the second image; and

(2) multiplying each term of the estimation objective function by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function.

15. (Previously presented) One or more computer-readable media as recited in claim 1412, after converting and before estimating, further comprising:

adding an inequality constraint on a particular parameter of the parameters, such that the particular parameter is constrained within a predetermined minimum and maximum value.

16. (Original) One or more computer-readable media as recited in claim 15:

wherein the predetermined minimum value and the predetermined maximum value are based on absolute values of other of the locations.

17. (Original) One or more computer-readable media as recited in claim 15, further comprising converting the inequality constraint to an equality constraint using a penalty function.

18. (Previously presented) One or more computer-readable media as recited in claim 1412, wherein the estimation objective function is used to determine an initial estimate of image rotation, wherein the first transform is a first pose transform corresponding to the first image, and wherein the second transform is a second pose transform corresponding to the second image, and wherein estimating further comprises:

placing an inequality constraint on a particular parameter of the parameters, such that the particular parameter is constrained within a predetermined minimum and maximum value;

converting the inequality constraint to an equality constraint using a penalty function; and

adding the equality constraint to the initial estimate.

19. (Previously presented) One or more computer-readable media as recited in claim 18, wherein multiplying further comprises multiplying the equality constraint by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function.

20. (Previously presented) One or more computer-readable media as recited in claim 14~~12~~, wherein the determining comprises accepting input from a human user.

21. (Canceled).

22. (Previously presented) A method as recited in claim 26~~21~~, wherein the identified locations correspond to the eye corners, mouth corners and nose tip.

23. (Previously presented) A method as recited in claim 26~~21~~, wherein the identifying comprises accepting input from a human user.

24. (Previously presented) A method as recited in claim 26~~21~~, further comprising multiplying the refined head motion estimate by a confidence factor that indicates that each of the identified locations was identified with a same level of accuracy.

25. (Canceled).

26. (Previously presented) A method to estimate head motion between two images of a face, the method comprising:

identifying locations of a plurality of distinct facial features in the two images, the locations corresponding to a number of unknowns determined upon estimation of head motion, the number of unknowns being determined by a number of equations;

converting the locations into set of physical face parameters based on the symmetry of the identified distinct facial features, the set of physical face parameters reducing the number of unknowns as compared to the number of equations used to determine the unknowns;

determining an initial estimation of head motion between the two images using the set of physical face parameters as follows:

(1) calculating an estimation objective function comprising a number of terms to estimate each of: (a) the set of coordinates, (b) a first head pose transform corresponding to the first image, and (c) a second head pose transform corresponding to the second image; and

(2) multiplying each term of the estimation objective function by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function; and

refining the initial estimation of head motion by incorporating the initial estimation into a feature matching algorithm.

27. (Previously presented) A method as recited in claim 26~~21~~, after the converting and before the determining, further comprising:

adding an inequality constraint on a particular parameter of the physical face parameters, such that the parameter is constrained within a predetermined minimum and maximum value.

28. (Currently amended) A method as recited in claim 27:

wherein the particular parameter corresponds to the nose tip; and

wherein the predetermined minimum value is zero (0) and the predetermined maximum value is a ~~reasonable~~ value based on absolute values of other of the locations.

29. (Original) A method as recited in claim 27, further comprising converting the inequality constraint to an equality constraint using a penalty function.

30. (Previously presented) A method as recited in claim 26~~21~~, wherein the determining further comprises:

adding an inequality constraint on a particular parameter of the physical face parameters, such that the particular parameter is constrained within a predetermined minimum and maximum value;

converting the inequality constraint to an equality constraint using a penalty function; and

adding the equality constraint to the initial estimate.

31. (Previously presented) A method as recited in claim 30, wherein in the operation of determining further comprises operations of multiplying the equality constraint by a weighted contribution factor based on the confidence of data corresponding to the estimation objective function.

32. (Previously presented) A computer-readable medium storing computer-executable instructions that, when executed on a computer, perform the method of claim 26~~21~~.

33. (Canceled).

34. (Canceled).

35. (Canceled).

36. (Previously presented) A computing device to estimate motion between two images, the computing device comprising:

a processor; and

a memory coupled to the processor, the memory comprising computer-program instructions executable by the processor for:

identifying locations of a plurality of distinct features in the two images, the locations corresponding to symmetrical features shared between the two images, the locations corresponding to a number of unknowns determined upon estimation of motion between the two images;

converting the locations into a set of parameters based on the symmetry of the identified distinct features, the parameters reducing the number of unknowns as compared to a number of equations used to determine the unknowns;

estimating motion between the two images using the parameters by:

(1) calculating an estimation objective function comprising a number of terms to estimate each of: (a) the parameters, (b) a first image pose transform corresponding to the first image, and (c) a second image pose transform corresponding to the second image;

(2) multiplying each term of the estimation objective function by a weighted contribution factor based on the confidence of that corresponding data;

(3) providing an initial estimate of image rotation by estimation of each of the parameters, a first image pose transform corresponding to the first image, and a second image pose transform corresponding to the second image;

(4) adding an inequality constraint on a particular parameter of the parameters, such that the particular parameter is constrained within a predetermined minimum and maximum value;

(5) converting the inequality constraint to an equality constraint using a penalty function; and

(6) adding the equality constraint to the initial estimate.

37. (Canceled).

38. (Canceled).

39. (Previously presented) A method to estimate motion between two images, the method comprising:

identifying locations of a plurality of distinct features in the two images, the locations corresponding to symmetrical features shared between the two images, the locations corresponding to a number of unknowns determined upon estimation of motion between the two images;

converting the locations into a set of parameters based on the symmetry of the identified distinct features, the parameters reducing the number of unknowns as compared to a number of equations used to determine the unknowns; and

estimating motion between the two images using the parameters by:

providing an initial estimate of image rotation by estimation of each of the parameters, a first image pose transform corresponding to the first image, and a second image pose transform corresponding to the second image;

multiplying each term of a set of terms used to determine the initial estimate by a weighted contribution factor based on the confidence of data corresponding to the initial estimate;

adding an inequality constraint on a particular parameter of the parameters, such that the particular parameter is constrained within a predetermined minimum and maximum value;

converting the inequality constraint to an equality constraint using a penalty function; and

adding the equality constraint to the initial estimate.

40. (Previously presented) A computer-readable medium storing computer-executable instructions that, when executed on a computer, performs the method of claim ~~3933~~.

41. (Canceled).

42. (Canceled).